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Changes in the Global Wave Climate from Single-Model Projections

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Abstract
Ocean surface wind waves are of outmost relevance for practical and scientific reasons. On the one hand waves have a direct impact in coastal erosion, but also in sediment transport and beach nourishment, in ship routing and ship design, as well as in coastal and offshore infrastructures, just to mention the most relevant. On the other hand waves are part of the climate system, and modulate most of the exchanges that take place at the atmosphere-ocean interface. In fact waves are the “ultimate” air-sea interaction process, clearly visible and noticeable. Up until recently the impact of climate change in future global wave climate had received very little attention. Some single model single scenario global wave climate projections, based on CMIP3 scenarios, were pursuit and received relative attention in the IPCC (Intergovernmental Panel for Climate Change) AR5 (Fifth Assessment Report). In the present study the impact of a warmer climate in the future global wave climate is investigated through a 3-member “coherent” ensemble of wave climate projections: single-model, single-forcing, and single-scenario. In this methodology model variability is eliminated, leaving only room for the climate change signal. The three ensemble members were produced with the wave model WAM, forced with wind speed and ice coverage from EC-Earth projections, following the representative concentration pathway with a high emissions scenario 8.5 (RCP8.5). The ensemble present climate reference period (the control run) has been set for 1971 to 2005. The projected changes in the global wave climate are analyzed for the 2071-2100 period. The ensemble reference period is evaluated trough the comparison with the European Centre for medium-range weather forecasts (ECMWF) ERA-Interim reanalysis.